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(72) Inventor: **Bernini, Michele, SKG Italiana SPA  
43040 Scarzara (Parma) (IT)**

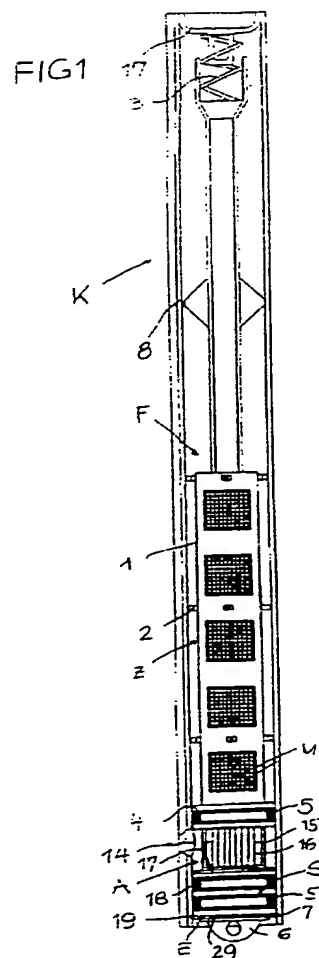
(74) Representative: **Grünecker, Kinkeldey,  
Stockmair & Schwanhäusser Anwaltssozietät  
Maximilianstrasse 58  
80538 München (DE)**

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(71) Applicant: **SKG ITALIANA SPA  
43040 Scarzara (Parma) (IT)**

### (54) Filter cartridge and condenser

(57) A filter cartridge F in a condenser K for an automobile air-conditioning system comprises a permeable housing 1 containing a desiccant charge, said housing being inserted into a header pipe 8 of said condenser which header pipe is closed by a plug S being part of said filter cartridge F. In a condenser K being equipped with a filter cartridge F in header tube 8 which is closed by a plug S said plug is made from plastic material or light metal and is part of said filter cartridge F to fulfil a dual function, namely to seal the header tube and to position the cartridge.



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## Description

[0001] The invention relates to a filter cartridge according to the preamble part of claim 1 as well as to a condenser according to the preamble part of claim 12.

[0002] A filter cartridge as known from EP-A-0 669 506 is provided within a collecting tube or header pipe of the condenser and is sealed and positioned by means of a metallic plug screwed into the insertion opening of said tube. Since said filter cartridge is supported in its operating position under a certain axial load, it simultaneously is backed up by the plug. This is a conventional structural principle of filter cartridge equipped condensers. There is a relatively precisely machined and tight thread connection provided between the plug and the insertion opening. This is expensive. However, since the condenser or the condenser housing during manufacturing, e.g. during soldering, is thermally loaded relatively strong, without the filter cartridge positioned within the header pipe, deformations of the insertion opening might occur so that the plug cannot be screwed in easily later and might not be sufficiently tight. Moreover, further irregularities between the plug and the insertion opening at the threaded connection might result from unavoidable temperature variations and corrosion effects and varying mechanical loads during operation of the condenser. This makes its particularly complicated to remove the plug for a change of the filter cartridge after a long duration use of the condenser. Even if then the plug can be removed in a troublesome way it often cannot be used a second time. Also a new plug then does not fit properly into the insertion opening. This problem might cause expensive and time-consuming re-machining efforts.

[0003] It is a task of the invention to provide a filter cartridge as well as a condenser with a filter cartridge, as mentioned above, which are structurally simplified and which allow assembly and disassembly and an exchange of the filter cartridge in a comfortable way.

[0004] Said task can be achieved by the features contained in claim 1 and in view to the condenser by the features of claim 11.

[0005] Since the plug is a part of the filter cartridge a separate manufacturing of a proper plug is avoided. The plug is mounted in the insertion opening first when also the filter cartridge is inserted. The plug then hermetically seals the insertion opening against the outer environment. Simultaneously the plug takes care of the correct positioning of the cartridge. The plug does not need to be screwed-in so that a threaded connection sensitive to deformation is avoided. The plug, instead, can be pressed in axially and secured in position by simple fastening elements.

[0006] The dual function plug made from plastic material as or light metal forming a part of the filter cartridge offers the possibility of a simple and comfortable assembly of the cartridge into the condenser, since the plug is introduced or pressed into the header pipe together with

the filter cartridge until the filter cartridge and the plug reach their respective and correct positions. The plug is able to adapt itself to the shape of the insertion opening, even if the insertion opening should have been deformed during the thermal treatment of the condenser or condenser housing or de-forms during operation. The necessary tightness is assured permanently. Removal, e.g. for exchanging the filter cartridge, of the plug can be carried out comfortably. The plug seals the collector tube and positions the cartridge.

[0007] As the filter cartridge has to be secured in the long header pipe of the condenser in its correct operating position, it is expedient, to provide the filter cartridge with a spacer and to provide the plug directly at said spacer.

[0008] Said plug can be connected detachably with the spacer or can be formed e.g. from plastic material unitary with the spacer.

[0009] Expediently the plastic or light metal spacer comprising the plug is detachably connected to the housing of the filter cartridge.

[0010] In order to achieve a correct positioning of the filter cartridge it is of advantage to support the spacer in the housing of the filter cartridge in a yieldable fashion (to axially pre-load the cartridge).

[0011] In an alternative embodiment the plug is provided at the lower end of the housing of the filter cartridge. In this case this is a filter cartridge which is inserted through a lower insertion opening into the header pipe of the condenser and which is positioned by the plug.

[0012] In view to manufacturing it is of advantage if the plug is a cylindrical body of plastic material or light metal with in-built sealing grooves and a supporting element like a surface for a securing element. Said plug is brought into its sealing position essentially only by axially pressing it into the insertion opening. Sealings provided in said grooves, preferably several O-rings, assure the necessary tightness. The supporting surface bears against the securing element such that the plug and by means of the plug also the filter cartridge remain properly positioned.

[0013] For an easy removal of the filter cartridge a gripping flap can be formed on the plug.

[0014] Alternatively or additionally a seat socket for a sensor and/or a filling valve can be formed in said plug.

[0015] The housing of the filter cartridge is equipped in the outlet zone with filter material having small pores the sizes of which suffice to retain even the smallest particles. To the contrary, the inlet zone is provided with micro-bores assuring a strong and uniform flow of the refrigerant towards the desiccant charge within the housing. Said micro-bores can be produced far less expensively in an injection mould than to mould a conventional cage-like housing portion. Said micro-bores can be formed by needle-like inserts in the injection mould and during the injection process of the housing. Expediently said needle-like inserts extend perpendicular to the

mould separation plane such that they can be positioned stationarily within the form and are pulled out from the product when the mould halves are separated.

[0016] Said filter cartridge can be assembled easily into the condenser and can be changed at any time through the insertion opening, irrespective where said opening is located. The plug as a part of the filter cartridge is provided at the respective end of the filter cartridge, and consists expediently of plastic material or light metal. The plug is positioned in the insertion opening by an essential axial pushing movement and does not need a threaded connection. The plug maintains its position with the help of the securing element positively engaging into the inner wall of the insertion opening. Said securing element hinders the plug to inadvertently move out from the insertion opening. Said securing element can be a Seeger-ring which is available in different sizes and with low costs. Seeger-rings are easy to mount and remove and generate the necessary holding force for the plug in a positive fashion.

[0017] In another embodiment said securing element may be a clip or a locking pin extending from outside through said header pipe and said plug. Said securing element can be removed and mounted comfortably and establish a high degree of safety against accidental removable. Said clip or locking pin may be inserted into a lateral shaft provided in the plug such that the plug neither can be pressed inwardly nor can escape from the header pipe. Expediently said clip or locking pin has an insertion end and at its opposite end a holding end. Said holding end positively is supported at the outer side of the header pipe, while another safety element can be inserted into the protruding insertion end. Said safety element may be a spring ring or a spring clip or even a lock. The clip or locking pin can be made of metal or plastic material.

[0018] Expediently said clip is formed like an elastic tongue which is flat in lateral direction and has a width smaller than the width of the shaft in the plug and is formed with a bend such that it can be held under preload when inserted to more safely secure the plug in its position.

[0019] Another embodiment uses a bayonet system for securing the plug in its position. A guiding curve can be provided, e.g. at the inner side of the wall of the header pipe for an engaging element of the plug. In case that said guiding curve is U-shaped the bayonet provides a further safety aspect, because the plug has to be first pressed in for the removing rotation of the bayonet design. However, the plug only can be pressed in if there is no significant pressure within said header pipe. As long as there is residual pressure, the bayonet closure cannot be opened until the pressure has been vented in the conventional way. This protects the car mechanic or the car owner when trying to exchange the filter cartridge with the system under pressure.

[0020] Embodiments of the invention will be explained with the help of the drawing. In the drawing is:

- Fig. 1 a longitudinal section of a part of a condenser with inserted filter cartridge,
- 5 Fig. 2 a part as emphasised in Fig. 1 by circle, in enlarged scale and partial in sectional view,
- Fig. 3 a front view of another embodiment of a filter cartridge,
- 10 Fig. 4 a detail belonging to Fig. 3,
- Fig. 5 a part of a further embodiment of a filter cartridge in its operating position in a header pipe of a condenser, and
- 15 Figs 6, 7 & 8 three interrelated sections of another embodiment.
- 20

[0021] Fig. 1 shows a header pipe 8, e.g. a vertical header pipe at one end of a condenser K, in a longitudinal section. In said header pipe 8 a filter cartridge F is positioned in its operating position. Said filter cartridge F contains inter alia a charge of a desiccant serving to extract water from the refrigerant circulating through the condenser water and also to retain particles contained in the refrigerant. Said filter cartridge F has a generally tube-shaped housing 1 with an inlet zone Z and an outlet zone A. In-between a ring flange 4 carrying at least one sealing element 5 serves as a separation wall co-operating with the header tube 8. Said housing 1 may have integrated distance elements 2. Moreover, at the upper end of housing 1 a spacer 3, e.g. equipped with a spring element, is provided abutting at a cap 17 e.g. soldered into header pipe 8.

[0022] In this embodiment filter cartridge F is inserted into the header pipe through a downwardly facing insertion opening E. The filter cartridge is positioned in header pipe 8 by a plug S closing the header pipe insertion opening E.. Plug S is made from plastic material or light metal and is part of the filter cartridge F. Plug S is pressed essentially linearly into said insertion opening E and is sealing with the help of O-rings 5. Plug S maintains its position thanks to a securing element 7 which positively is fixed in the mouth of insertion opening E. A gripping flap 6 can be formed a plug S.

[0023] Housing 1 has a plurality of micro-bores M in its inlet zone Z. Outlet openings 15 of the housing 1 in said outlet zone A are covered by filter material 16 having fine pores. The refrigerant, mainly in its liquid phase, enters header tube 8, and enters housing 1 through said micro-bores M. From the interior of housing 1 and after having passed at least the desiccant the refrigerant exits through the filter material 16 and leaves said header pipe 8 through a side opening 14.

[0024] Fig. 2 shows how securing element 7 is insert-

ed into a groove 19 formed within insertion opening E. It abuts against a supporting element 29 e.g. a surface of plug S. Plug S has circumferential grooves 18 for O-rings 5.

[0025] Said micro-bores M expediently are formed during injection moulding of housing 1 by means of needle-shaped inserts in the injection mould. In case that said needle-shaped inserts are oriented perpendicular to the separation plane of the injection mould the final injection moulded product can be removed easily. This is simpler in view to production and the design of the injection mould than to form said inlet zone Z as a cage-like structure. Said plug S in Fig. 1 is either formed unitarily with housing 1 or is fixed thereto.

[0026] In Fig. 2A the securing element 7 is a bayonet closure having at least one engagement element 34 e.g. provided at plug S and at least one guiding curve 35 provided e.g. in the inner wall of header pipe 8. Said bayonet closure 33 provides an additional safety aspect, since it needs for removal to first press plug S into header pipe 8, in order to move engagement element 34 in the U-shaped guiding curve 35. Even relatively low system pressure within header pipe 8 inhibits said inward motion of plug S and first has to be relieved for protecting the mechanic or the environment against the cooling agent in the system.

[0027] In Fig. 2B said securing element 7 is a clip, splint or locking pin 36 seated within channels 37, 38 provided in plug S and within the wall of header tube 8.

[0028] The filter cartridge F as shown in Fig. 3 is intended to be inserted into a header pipe (not shown in Fig. 3) from the upper end. The inlet zone Z of housing 1 is defined by a plurality of micro-bores M. Said inlet zone Z is separated from the outlet zone A by a sealing lip 4'. In order to position the housing 1 deep enough essentially within the liquid phase of the refrigerant in header pipe 8, a spacer D is connected to the housing 1. Said spacer D carries plug S at its end opposite to housing 1. Sidewardly oriented wings 21 on spacer D serve to centre it within the header tube 8. Housing 1 is formed with an upper opening and an annular inner flange 26. A lower flange 24 of spacer D can be forced by resilient deformation past said annular flange 26 in order to connect the spacer D and the housing 1, e.g. after inserting the desiccant-charge.

[0029] According to Fig. 4 the plug S is designed with a lower threaded blind bore 22 into which a threaded protrusion 23 of spacer D is screwed. The lower flange 24 is positioned at spacer D by means of a locking nut 25.

[0030] In the embodiment of Fig. 5 the filter cartridge F is provided, similarly as in Fig. 3, with a lower housing 1 and an upper spacer D. Spacer D rests with its flange 24 on a compression spring 30 supported by a lid 31 within housing 1, such that housing 1 is pre-loaded downwardly in its working position, once spacer D and plug S are correctly positioned by securing element 7. Plug S is unitarily provided at the upper end of spacer

D and is made from the same plastic material or light metal as the spacer. The plug is provided in an upper insertion opening E of header pipe 8 and is secured in its position without a threaded connection by securing element 7, e.g. a Seeger-ring, seated in a groove 19 in the mouth of insertion opening E. Securing element 7 abuts supporting surface 29 of plug S. In this embodiment plug S is provided with a socket 27 for e.g. a sensor or a filling fitting 28 with a filling valve. A channel 32 leads from socket 27 downwardly to the side of spacer D.

[0031] During assembly of the filter cartridge F into header pipe 8 of the condenser K first the filter cartridge F is inserted until plug S has reached the proper position. Then securing element 7 is inserted. In order to change the filter cartridge the securing element 7 is removed and the filter cartridge then can be pulled out, e.g. by means of gripping flap 6.

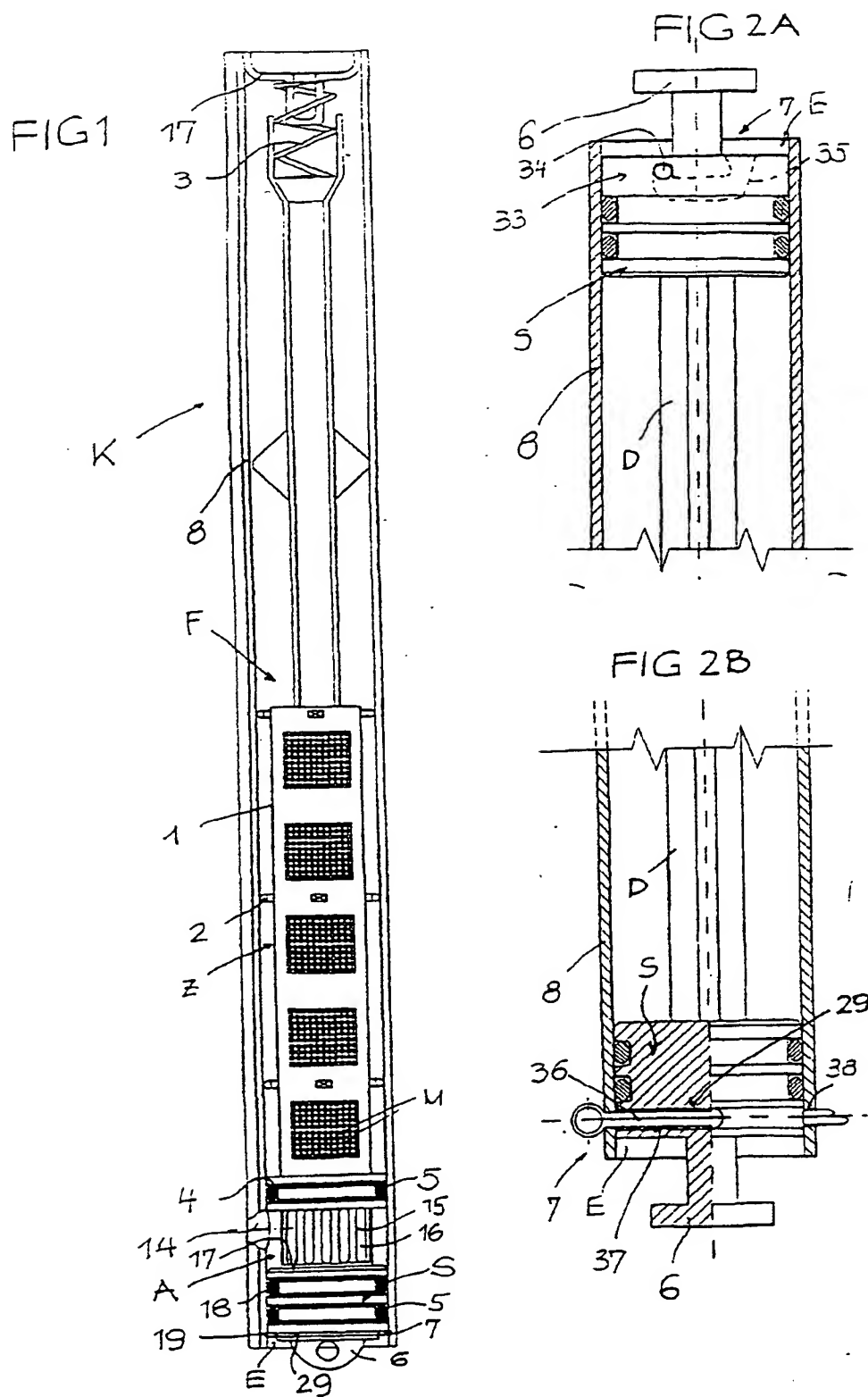
[0032] In Figs 6, 7 and 8 securing element 7 is clip 36 of a special design inserted into openings 38 in the wall of the header pipe 8 and in a lateral shaft 39 formed within plug S and defining said supporting element 29. Both ends 40, 41 of said clip 36 protrude beyond the wall of header pipe 8. Said clip 36 can be made from metal or plastic and is designed as a flat, elastic tongue in Fig. 6 having, according to the view of Fig. 8, an arc-shaped bend 43. Since lateral shaft 39 is broader perpendicular to the axis of header pipe 8 than the width of clip 36, but the bend 43 is stronger than the width of the lateral shaft 39 the inserted clip 36 is pre-loaded. It is supported by said pre-load within openings 38 and at the wall of lateral shaft 39. Holding end 40, e.g. a side-wards bent end portion, abuts the outer side of header pipe 8. Insertion end 41 protruding at the opposite side receives safety element 42 (e.g. a spring ring or a spring clip as shown in Fig. 7) or even a lock preventing that clip 36 can be pulled out accidentally.

[0033] Said clip system can be manufactured with low cost, because e.g. the openings in the header pipe as well as the lateral shaft in the plug can be formed by pressing or injection moulding.

#### Claims

1. Filter cartridge (F) in a condenser (K), particularly for an automobile air conditioning system, comprising a permeable housing (1) containing at least one desiccant charge, which housing is inserted through an insertion opening (E) into a header pipe (8) of said condenser (K), said insertion opening (E) being closed by a plug (S) characterised in that said plug (S) is part of said filter cartridge (F).
2. Second filter cartridge as in claim 1, characterised in that said housing (1) of the filter cartridge (F) has an longitudinal spacer (D), and that said plug (S) is provided at a free end of said spacer (D).

3. Filter cartridge as in claim 2, **characterised in that** said spacer (D) is made from plastic material or light metal, and that said plug (S) is also made from plastic material or light metal and is detachably or unitarily provided at said spacer (D).
4. Filter cartridge as in claim 2, **characterised in that** said spacer (D) is separable from said housing (1) at its end opposite to said plug (S), and that said spacer (D) is yieldably supported within said housing (1) preferably by means of a spring (30).
5. Filter cartridge as in claim 1, **characterised in that** said plug is provided at a lower end of said housing (1) of said filter cartridge (F).
6. Filter cartridge as in claim 1, **characterised in that** said plug (S) is a generally cylindrical body (17) made from plastic material or light metal comprising at least one circumferential groove (18) for a sealing element (5) and an axial supporting element (29) for a securing element (7).
7. Filter cartridge as in claim 1, **characterised in that** an outer gripping flap (6) is formed at said plug (S).
8. Filter cartridge as in claim 1, **characterised in that** a socket (27) for a sensor or a filling valve fitting (28) is provided within said plug (S).
9. Filter cartridge as in at least one of the preceding claims, **characterised in that** said housing (1) is separated into an inlet zone (Z) and an outlet zone (A) both being separated from another by an outer sealing lip (4') or an annular flange (4), and that in said outlet zone (A) a filter fabric element (16) with fine pores is provided, while in said inlet zone (C) micro-bores (M) are formed in the wall of said housing (1).
10. Filter cartridge as in claim 9, **characterised in that** said micro-bores (M) are formed by needle-shaped inserts in an injection mould for forming said housing (1).
11. Condenser (K), particularly for an automobile air conditioning system, comprising a header tube (8) having an insertion opening (E), a filter cartridge (F) removably positioned within said header pipe (8) and containing a desiccant, and comprising a plug (S) sealingly closing said insertion opening (E) **characterised in that** said plug (S) is made from plastic material or light metal and is part of said filter cartridge (F).
12. Condenser as in claim 11, **characterised in that** said plug (S) of said filter cartridge (F) is secured within the upwardly facing or downwardly facing insertion opening (E) by means of a securing element (7) engaging into the wall of said insertion opening (S) and abutting against an outer supporting element (29) of said plug (S).
13. Condenser as in claim 12, **characterised in that** said securing element (7) is a Seeger-ring seated in a groove of said insertion opening (E).
14. Condenser as in claim 12, **characterised in that** said securing element (7) is a clip or locking pin (36) extending from outside through the wall of said header pipe (8).
15. Condenser as in claim 12 or 14, **characterised in that** said supporting element (29) is a lateral shaft (39) formed within plug (S) for receiving said clip or locking pin (36).
16. Condenser as in claim 14 or 15, **characterised in that** said clip or locking pin (36) has an insertion end (41) and a holding end (40), said holding end being positively abutting the outer side of said header pipe (8), said insertion end (41) where protruding beyond said header pipe (8) receiving an additional safety element (42) blocking said clip or locking pin (36) against being pulled out.
17. Condenser as in claim 14, **characterised in that** said clip or locking pin (36) is made from metal or plastic material.
18. Condenser as in claim 16, **characterised in that** said clip or locking pin (36) is formed as an elastic tongue with a width perpendicularly to the axis of said header pipe smaller than the width of said lateral shaft (39) is said plug (S) and having in width direction an arc-shaped bend (43) such that the inserted clip or locking pin (36) is pre-loaded in bending direction in openings (38) of the wall of said header pipe (8) and within said lateral shaft (39).
19. Condenser as in claim 12, **characterised in that** said securing element (7) is part of a bayonet closure (33), comprising at least one guiding curve (35) and at least one engaging element (34), said guiding curve (35) either being formed in the wall of said header pipe (8) or said plug (S) and the engaging element (34) being formed either at said plug (S) or at the wall of said header pipe (8), respectively.



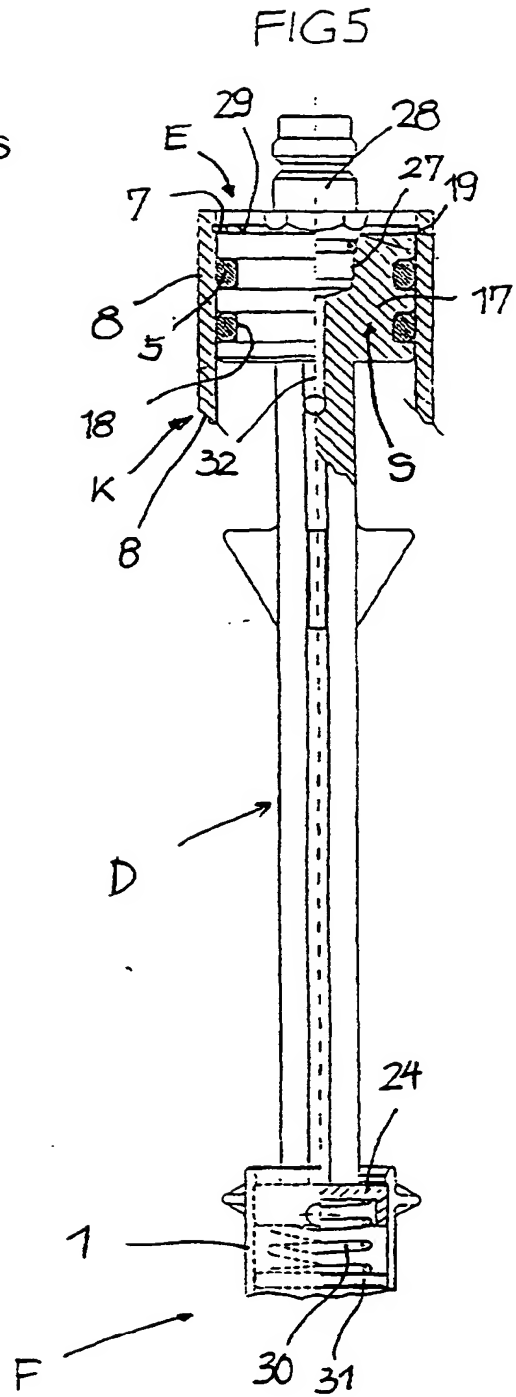
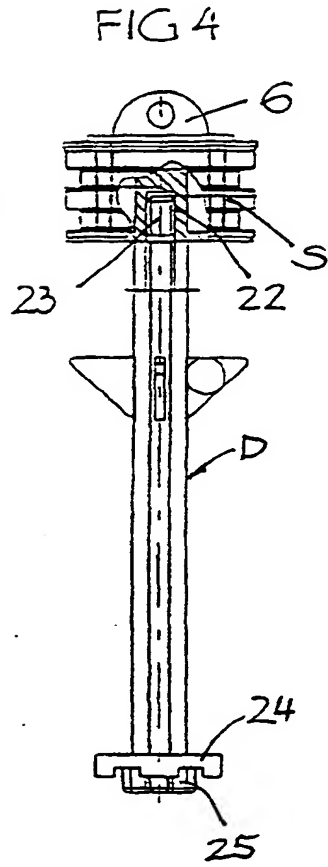
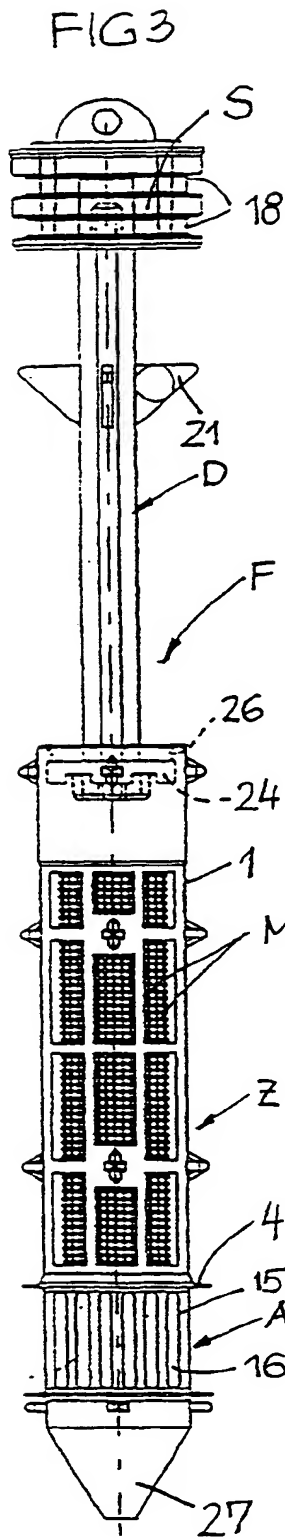


FIG 6

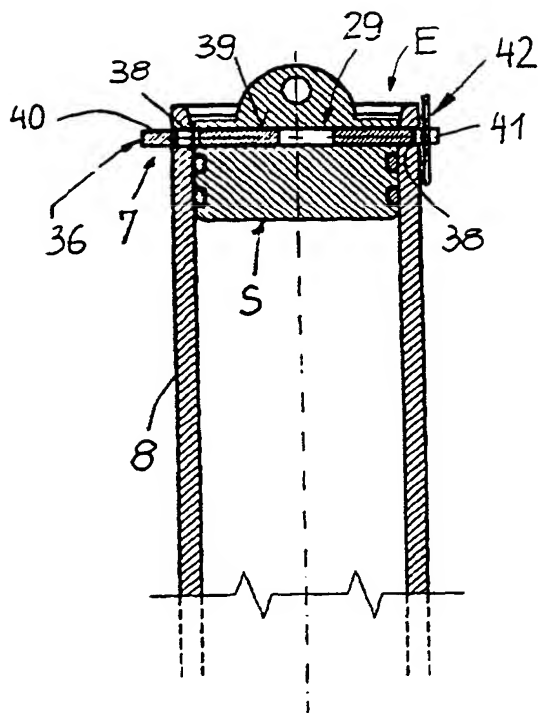


FIG 7

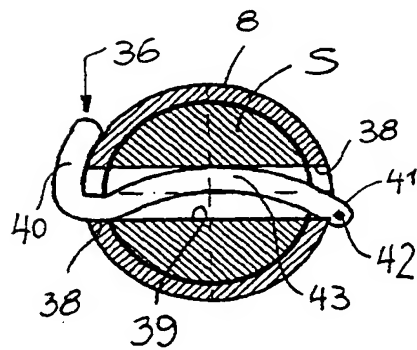
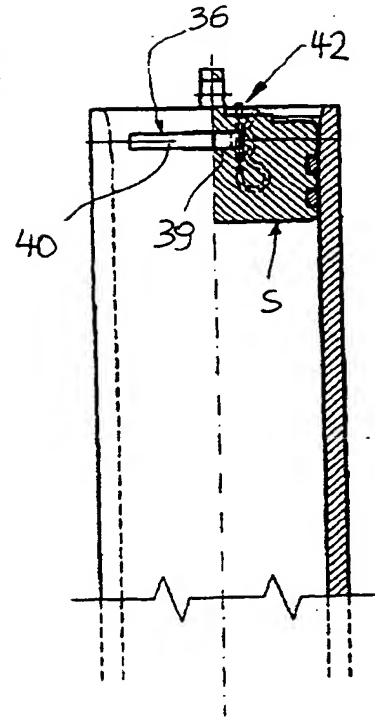


FIG 8





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# EUROPEAN SEARCH REPORT

Application Number  
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Place of search THE HAGUE		Date of completion of the search 11 June 2001	Examiner Jessen, F
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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